## CLAIMS

1. A method of preparing a layered composite electrode/electrolyte structure, comprising:

contacting a mixture consisting essentially of particles selected from the group consisting of an electronically-conductive electrode material and a homogeneous mixed ionically electronically-conductive (MIEC) electrode material with a layer comprising an ionically-conductive electrolyte material to form an assembly comprising a layer of the mixture on at least one side of the layer of the electrolyte material;

sintering the assembly to form a porous electrode in contact with a gas-tight electrolyte membrane; and

infiltrating the sintered assembly with a solution or dispersion of an electrocatalyst precursor, the electrocatalyst precursor comprising at least one transition metal nitrate.

2. The method of claim 1, wherein the electrode material is one of a metal and a metal alloy.

3. The method of claim 1, wherein the electrode material is selected from the group consisting of transition metals Cr, Fe, Cu, Ag and Pt.

4. The method of claim 1, wherein the electrode material is selected from the group consisting of a chromium-containing ferritic steel, a chrome-based alloy and a chrome-containing nickel-based alloy.

5. The method of claim 4, wherein the chrome-based alloy is Cr5Fe1Y.

6. The method of claim 4, wherein the alloy is a chrome-containing nickel-based alloy.

7. The method of claim 1, wherein the electrode material is a MIEC ceramic.

8. The method of claim 7, wherein the MIEC is a ceramic selected from the group consisting of $La_{1-x}Sr_xMn_yO_{3-\delta}$ ($1 \geq X \geq 0.05$) ($0.95 \leq y \leq 1.15$), $La_{1-x}Sr_xCoO_{3-\delta}$ ($1 \geq X \geq 0.10$, $SrCo_{1-x}Fe_xO_{3-\delta}$ ($0.30 \geq X \geq 0.20$), $La_{0.6}Sr_{0.4}Co_{0.6}Fe_{0.4}O_{3-\delta}$, $Sr_{0.7}Ce_{0.3}MnO_{3-\delta}$, $LaNi_{0.6}Fe_{0.4}O_{3-\delta}$, and $Sm_{0.5}Sr_{0.5}CoO_{3-\delta}$.

9. The method of claim 8, wherein the $La_{1-x}Sr_xMn_yO_{3-\delta}$ is selected from the group consisting of $La_{0.8}Sr_{0.2}MnO_{3-\delta}$, $La_{0.65}Sr_{0.35}MnO_{3-\delta}$ and $La_{0.45}Sr_{0.55}MnO_{3-\delta}$.

10. The method of claim 1, wherein the ionically-conductive electrolyte material is selected from the group consisting of yttria-stabilized zirconia, scandia-stabilized zirconia, doped ceria, doped lanthanum gallate and doped bismuth oxide.

11. The method of claim 10, wherein the ionically conductive electrolyte material comprises yttria-stabilized zirconia.

12. The method of claim 1, wherein the electrode material is $La_{1-x}Sr_xMn_yO_{3-\delta}$ ($1 \geq X \geq 0.05$) ($0.95 \leq y \leq 1.15$) and the electrolyte material is yttria-stabilized zirconia.

13. The method of claim 1, wherein the transition metal salt is at least one of Fe nitrate, Co nitrate, Mn nitrate, Ce nitrate, Sr nitrate, Ni nitrate and Ag nitrate.

14. The method of claim 13, wherein the at least one transition metal nitrate is Co nitrate.

15. The method of claim 1, wherein the electrolyte layer is gas-tight prior to sintering of the assembly and remains gas-tight upon sintering of the assembly.

16. The method of claim 1, wherein the electrolyte layer is gas-permeable prior to sintering of the assembly and becomes gas-tight upon sintering of the assembly.

17. The method of claim 1, wherein said electrode is an oxygen electrode.

18. The method of claim 1, wherein said electrode is a hydrogen electrode.

19. A method of preparing a layered composite electrode/electrolyte structure, comprising:

contacting a mixture consisting essentially of particles of a metal alloy selected from the group consisting of a chromium-containing ferritic steel, a chrome-based alloy and a chrome-containing nickel-based alloy with a layer comprising an ionically-conductive electrolyte material to form an assembly comprising a layer of the mixture on at least one side of the layer of the electrolyte material;

sintering the assembly to form a porous electrode in contact with a gas-tight electrolyte membrane; and

infiltrating the sintered assembly with a solution or dispersion of an electrocatalyst precursor.

20. The method of claim, 19 wherein the alloy is a chrome-based alloy.

21. The method of claim 20, wherein the chrome-based alloy is Cr5Fe1Y.

22. The method of claim 19, wherein the electrolyte membrane is a material selected from the group consisting of scandia stabilized zirconia, doped ceria, doped lanthanum gallate and doped bismuth oxide.

23. The method of claim 19, wherein the electrolyte membrane material comprises yttria-stabilized zirconia.

24. The method of claim 19, wherein the electrocatalyst precursor comprises at least one of a transition metal salt, a rare earth metal salt, and any combination of one or more rare earth salts and transition metal salts.

25. The method of claim 24, wherein the the electrocatalyst precursor comprises at least one transition metal salt selected from the group consisting of Fe nitrate, Co nitrate, Mn nitrate, Ce nitrate, Sr nitrate, Ni nitrate and Ag nitrate.

26. The method of claim 25, wherein the at least one transition metal nitrate is Co nitrate.

27. The method of claim 19, wherein the electrolyte layer is gas-tight prior to sintering of the assembly and remains gas-tight upon sintering of the assembly.

28. The method of claim 19, wherein the electrolyte layer is gas-permeable prior to sintering of the assembly and becomes gas-tight upon sintering of the assembly.

29. The method of claim 19, wherein said electrode is an oxygen electrode.

30. The method of claim 19, wherein said electrode is a hydrogen electrode.